I. AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method of selecting a bit load *b* per sub-channel in a multicarrier system, the multicarrier system encoding data based on a constellation of points, each point representing a tuple of data, the constellation having a self-similarity property, comprising:

determining a probability of having *k* bit errors in an erroneous tuple (*p(k,b)*) based on Hamming distances between the points of the constellation;

estimating an average number of bit errors in an erroneous tuple based on said probability (p(k,b)); and

selecting the bit load per sub-channel based on the estimated number of bit errors in an erroneous tuple. ~~using an improved estimate of the bit error per symbol error based on the self-similarity property of the constellation.~~

2. (Cancelled)

3. (Cancelled)

4. (Currently Amended) The method of ~~claim 3~~ claim 1 wherein said average number of bit errors in the erroneous tuple is determined as follows:

$$\omega(b) = \frac{12 \cdot 2^{b} - (3b+2)2^{b/2} - 2b - 4}{6b \cdot 2^{b}}.$$

5. (Currently Amended) The method of ~~claim 2~~ claim 1 wherein said probability (*p(k,b)*) is determined as follows:

$$p(k,b)=\frac{1}{2^k}\left[1+\frac{2}{3\cdot 2^{b/2}}\right]+\frac{1}{2^k}\frac{2}{3}\left[\frac{1}{2^{b/2}}+\frac{2}{2^b}\right]\delta_{1k},\ 1\le k\le b/2\ .$$

$$\delta_{ij}=\begin{Bmatrix}1, where i=j\\0, where i\ne j\end{Bmatrix}.$$

6. (Previously Presented) The method of ~~claim 2~~ <u>claim 1</u> wherein said probability (*p(k,b)*) is determined as follows:

$$p(k,b)=\frac{1}{2^k}\left[1+O\left(\frac{1}{2^{b/2}}\right)\right],\ 1\le k\le b/2\,.$$

7. (Currently Amended) The method of ~~claim 2~~ <u>claim 1</u> wherein said probability (*p(k,b)*) approaches $1/2^k$ for constellations which have large values of *b*.

8. (Previously Presented) The method of claim 1 wherein said constellation is square.

9. (Previously Presented) The method of claim 1 wherein said constellation is non-square.

10. (Previously Presented) The method of claim 1 wherein the sub-channel has a bit error rate, and further comprising:

determining a mean square deviation of the number of bit errors in an erroneous tuple;

wherein said selecting further comprises selecting the bit load per sub-channel based on said mean square deviation of the number of bit errors in an erroneous tuple.

11. (Previously Presented) The method of claim 10 wherein said mean square deviation of the number of bit errors in an erroneous tuple σ_e is determined based on the following relationship:

$$\sigma_e^2 = 2 - \frac{3b^2 + 24b + 20}{12 \cdot 2^{b/2}} + \frac{(6b+4)2^{b/2} - b^2 - 4}{6 \cdot 2^b} + \left(\frac{(3b+2)2^{b/2} + 2b + 4}{3 \cdot 2^b} \right)^2 .$$

12. (Previously Presented) The method of claim 10 wherein at large values of *b*, the mean square deviation of the number of bit errors in an erroneous tuple σ_e tends to the square root of two.

13. (Previously Presented) The method of claim 10 further comprising:

accessing a table of associated values of the number of bits *b* and the values of the mean square deviation of the number of bit errors in an erroneous tuple to retrieve a value of a particular mean square deviation of the number of bits errors in an erroneous tuple for a particular value of *b*; and

adjusting a target bit error rate to accommodate said value of said particular mean square deviation of the number of bit errors in an erroneous tuple to provide an adjusted target bit error rate, wherein said bit load is also selected based on said adjusted target bit error rate.

14. (Previously Presented) The method of claim 13 further comprising:

selecting at least one forward error correction parameter based on said adjusted target bit error rate.

15. (Previously Presented) The method of claim 1 wherein said selecting comprises:

determining a probability of having *k* bit errors in an erroneously decoded tuple as follows:

$$p(k, b_1, \ldots, b_J) = \sum_{j=1}^{J} \frac{2^{b_j}}{2^b} p\left(k \middle| symbol\ transmitted \in \Omega_j\ \&\ symbol\ received \in \Omega_j\right) + \sum_{\substack{j,m \\ m \neq j}}^{J} \left[\begin{array}{l} p\left(symbol\ transmitted \in \Omega_j\ \&\ symbol\ received \in \Omega_m\right) \\ \times\, p\left(k \middle| symbol\ transmitted \in \Omega_j\ \&\ symbol\ received \in \Omega_m\right) \end{array} \right]$$

where 2^{b_j} is the number of constellation points in each of J adjacent square sub-constellations Ω_j forming a non-square constellation, and sub-constellation Ω_j is different from sub-constellation Ω_m; and $\sum_{j=1}^{J} \frac{2^{b_j}}{2^{b}} = 1$.

16. (Currently Amended) The method of ~~claim 2~~ claim 1 wherein said constellation is non-square, and said probability of having k bit errors in an erroneously decoded tuple of the non-square constellation is estimated as if said non-square constellation was a square constellation.

17. (Currently Amended) The method of ~~claim 2~~ claim 1 wherein said constellation is non-square, and said probability of error of said non-square constellation becomes asymptotically close to the probability of error of a square constellation encoder.

18. (Cancelled)

19. (Currently Amended) A method of selecting a bit load b for a channel in a communications system, the communications system encoding data based on a non-square constellation of points, the non-square constellation having a self-similarity property, comprising:

determining a probability of having k bit errors in an erroneously decoded tuple ($p(k,b)$) based on the self-similarity property of the non-square constellation, wherein said probability of having k bit errors in an erroneously decoded tuple of the non-square constellation is estimated as if said non-square constellation was a square constellation;

selecting the bit load for the channel using said probability. ~~using an improved estimate of the bit error per symbol error based on the self-similarity property of the constellation.~~

20. (Previously Presented) The method of claim 19 wherein the channel has a bit error rate, and further comprising

determining a mean square deviation of the number of bit errors in an erroneous tuple;

wherein said selecting further comprises selecting the bit load based on said mean square deviation of the number of bit errors in an erroneous tuple.

21. (Cancelled)

22. (Previously Presented) The method of claim 19 wherein said self-similarity property is determined with respect to a Hamming distance between the points of the constellation.

23. (Currently Amended) An apparatus for selecting a bit load *b* for a channel in a communications system, the communications system encoding data based on a non-square constellation of points, the non-square constellation having a self-similarity property, comprising:

means for selecting the bit load for the channel using an improved estimate of ~~the~~ [[a]] bit error per symbol error based on the self-similarity property of the constellation, wherein said means for selecting comprises means for determining a probability of having *k* bit errors in an erroneously decoded tuple (*p(k,b)*) based on Hamming distances between the points of the non-square constellation, and wherein said probability of having *k* bit errors in an erroneously decoded tuple of the non-square constellation is estimated as if said non-square constellation was a square constellation.

24. (Previously Presented) The apparatus of claim 23 wherein the channel has a bit error rate, and said means for selecting further comprises means for determining a mean square deviation of the number of bit errors in an erroneous tuple, wherein said means for selecting selects the bit load based on said mean square deviation of the number of bit errors in an erroneous tuple.

25. (Cancelled)

26. (Currently Amended) An apparatus for selecting a bit load b per sub-channel in a multicarrier system, the multicarrier system encoding data based on a constellation of points, each point representing a tuple of data, the constellation having a self-similarity property, comprising:

means for determining a bit load per sub-channel using an ~~improved~~ estimate of ~~the~~ [[a]] bit error per symbol error ~~based on the self-similarity property of the constellation,~~ and forward error correction parameters, comprising means for determining a probability of having *k* bit errors in an erroneous tuple (*p(k,b)*) based on Hamming distances between the points of the constellation, and means for estimating an average number of bit errors in an erroneous tuple based on said probability (p(k,b)); and

means for selecting a bit load based on ~~the~~ [[a]] coding gain and the average number of bit errors in the erroneous tuple.

27. (Cancelled)

28. (Cancelled)

29. (Previously Presented) The apparatus of claim 26 wherein said probability (*p(k,b)*) is determined as follows:

$$p(k,b)=\frac{1}{2^k}\left[1+\frac{2}{3\cdot 2^{b/2}}\right]+\frac{1}{2^k}\frac{2}{3}\left[\frac{1}{2^{b/2}}+\frac{2}{2^b}\right]\delta_{1k},\ 1\leq k\leq b/2\ ,$$

$$\delta_{ij}=\begin{Bmatrix}1, where\, i=j\\0, where\, i\neq j\end{Bmatrix}.$$

30. (Previously Presented) The apparatus of claim 26 wherein said probability (*p(k,b)*) is determined as follows:

$$p(k,b)=\frac{1}{2^k}\left[1+O\left(\frac{1}{2^{b/2}}\right)\right],\ 1\leq k\leq b/2\ .$$

31. (Previously Presented) The apparatus of claim 26 wherein said probability (*p(k,b)*) approaches $1/2^k$ for constellations which have large values of *b*.

32. (Previously Presented) The apparatus of claim 26 wherein said constellation is square.

33. (Previously Presented) The apparatus of claim 26 wherein said constellation is non-square.

34. (Previously Presented) The apparatus of claim 26 wherein the sub-channel has a bit error rate, and said means for determining the bit load further comprises:

means for determining a mean square deviation of the number of bit errors in an erroneous tuple;

wherein said means for selecting also selects the bit load per sub-channel based on said mean square deviation of the number of bit errors in an erroneous tuple.

35. (Previously Presented) The apparatus of claim 34 wherein said means for determining the mean square deviation of the number of bit errors in an erroneous tuple determines said mean square deviation of the number of bit errors in an erroneous tuple σ_e in accordance with the following relationship:

$$\sigma_e^2=2-\frac{3b^2+24b+20}{12\cdot 2^{b/2}}+\frac{(6b+4)2^{b/2}-b^2-4}{6\cdot 2^b}+\left(\frac{(3b+2)2^{b/2}+2b+4}{3\cdot 2^b}\right)^2.$$

36. (Previously Presented) The apparatus of claim 35 wherein at large values of b, σ_e tends to the square root of two.

37. (Currently Amended) The apparatus of claim ~~37~~ [[34]] further comprising:

means for accessing a table of associated values of the number of bits b and the values of the mean square deviation of the number of bit errors in an erroneous tuple to retrieve a value of a particular mean square deviation of the number of bit errors in an erroneous tuple for a particular value of b; and

means for adjusting a target bit error rate to accommodate said value of said particular mean square deviation of the number of bit error in an erroneous tuple to provide an adjusted target bit error rate, wherein said means for selecting also selects said bit load based on said adjusted target bit error rate.

38. (Previously Presented) The apparatus of claim 37 wherein said means for selecting selects at least one forward error correction parameter based on said adjusted target bit error rate.

39. (Previously Presented) The apparatus of claim 26 wherein said means for determining a bit load comprises:

means for determining a probability of having k bit errors in an erroneously decoded tuple in accordance with the following relationship:

$$p(k, b_1, .., b_J) = \sum_{j=1}^{J} \frac{2^{b_j}}{2^b} p(k \mid symbol\ transmitted \in \Omega_j\ \&\ symbol\ received \in \Omega_j) + \sum_{\substack{j,m \\ m \neq j}}^{J} \left[\begin{array}{l} p(symbol\ transmitted \in \Omega_j\ \&\ symbol\ received \in \Omega_m) \\ \times\, p(k \mid symbol\ transmitted \in \Omega_j\ \&\ symbol\ received \in \Omega_m) \end{array} \right]$$

where 2^{b_j} is the number of constellation points in each of J adjacent square sub-constellations Ω_j forming a non-square constellation, and sub-constellation Ω_j is different from sub-constellation Ω_m; and $\sum_{j=1}^{J} \frac{2^{b_j}}{2^b} = 1$.

40. (Previously Presented) The apparatus of claim 26 wherein said constellation is non-square, and said probability of having *k* bit errors in an erroneously decoded tuple of the non-square constellation is estimated as if said non-square constellation was a square constellation.

41. (Previously Presented) The apparatus of claim 26 wherein said constellation is non-square, and said probability of error of said non-square constellation becomes asymptotically close to the probability of error of a square constellation encoder.

42. (Previously Amended) The apparatus of claim 26 wherein said self-similarity property is determined with respect to a Hamming distance between the points of the constellation.